REMARKS

In the Office Action mailed May 6, 2003, the Examiner noted that claims 1-27 were pending, that claims 12-27 have been withdrawn from consideration, objected to claims 3-5 and rejected claims 1, 2 and 6-11. Claims 1, 3, 6 and 8-11 have been amended, and, thus, in view of the forgoing claims 1-11 remain pending for reconsideration which is requested. No new matter has been added. The Examiner's rejections and objections are traversed below.

In the Action on page 2 the Examiner objected to the drawings and the drawings have been amended in consideration of the Examiners comments. Withdrawal of the objection is requested.

In the Office Action on pages 5 and 6, the Examiner objected to claim 3 and indicated that claim 3 along with claims 4 and 5 would be allowable if claim 3 was rewritten in independent form. Claim 3 have been so rewritten and it is submitted that these claims are now allowable. Withdrawal of the objection is requested.

On page 5 of the Office Action the Examiner rejected claims 1, 2, 8 and 10 under 35 U.S.C. § 102 as anticipated by Yamato.

The Examiner has indicated that the element 73 (a file-basis transmission time computing unit 73) in the third preferred embodiment of Yamato corresponds to the schedule unit of the present invention of claims 1, 8 and 10.

The file-basis transmission time computer unit 73 computes a time needed to transmit the data of an appropriate block to a client 60 before a request management unit 71 issues the read request of each block. Then, the unit 71 issues the read request of a block together with the computed time, which is the deadline time of the block (col. 16, lines 53-58).

In the third preferred embodiment of Yamato, the transfer rate of each file is stored in advance in a storage device 10, and a file designated by a successive read request is transmitted to a client at a transfer rate corresponding to the file (at the transfer rate stored in the storage device 10). A deadline time attached to the read request of each block is computed based on the transfer rate of a related file (the designated file). Therefore, the third embodiment can cope with a system for simultaneously and successively reading a plurality of files each having a different transfer rate, such as a video server system which deals with moving pictures of different coding formats (col. 14, lines 57-67).

The transfer rate of each file, stored in the storage device 10 is stored in advance. When the file is stored in the storage device 10, the transmission rate of each file is stored in a transfer rate table 72 (col. 15, lines 51-55). A deadline time (transfer starting time) is computed based on a file transfer rate, and the transfer of each block can be started at a time corresponding to the file transfer rate. This results in reading data of the subsequent block from the storage device 10 onto the transmission buffer 74 by the time the transfer of the preceding block is completed (col. 17, lines 19-23).

In Yamato, the deadline time (T_{start}) of the first block in a file is obtained by adding a deadline margin time (time t prescribed for the system) to a current time (time $T_{current}$ when a successive read request is received from the client 60) , as shown in the following expression (3) (col.16, line 65 - col. 17, line 17).

$$T_{start} = T_{current} + t \qquad\qquad (3)$$

The deadline times T_N of the second and the subsequent blocks are obtained by adding a value (L/S_j) obtained by dividing the data size L of the preceding block by the transfer rate S_j of a file in question registered in the transfer rate table 72, to the deadline time $T_{N\,1}$ of the lastly issued read request, as shown in the following expression (4).

$$T_N = T_{N-1} + (L/S_j) \qquad\qquad (4)$$

A comparator 24 compares deadline times of all the read requests stored in a queue 213 to select a read request with the earliest deadline time and notifies the queue 213 of the selected request (col. 8, lines 44-48). Each file read on a block basis in descending order of deadline times is transferred to the client 60 at a transfer rate registered corresponding to the file (col. 17, lines 52-57).

The Examiner has also alleged that the element 20 (read control device 20) shown in Fig. 10 corresponds to the control unit of the present invention.

The read control device 20 comprises a read request storing unit 21 storing read requests sent from a client 60 in the order determined based on a deadline time for reading (col. 8, lines 6-9).

The read request storing unit 21 shown in Fig. 3 comprises a queue 213 and a comparator 214. The queue 213 stores read requests from the client 30 in the order of acceptance. The comparator 214 determines a read request to be fetched from the queue 213, based on a deadline time attached to the read request. A read request sent from the client 30 is stored at the rear of the queue 213. In taking a read request out of the queue 213, the comparator 214 compares the deadline times of all the read requests stored in the queue 213 to

select a read request with the earliest deadline time, and notifies the queue 213 of the selected request (col. 8, lines 35-48). Each file is read in descending order of deadline times and is transferred to the client 60 at a transfer rate corresponding to the registered file.

The present invention, as recited in clams 1, 8 and 10, receives read requests and write requests as access requests and processes the requests, while Yamato targets only read requests for processing.

As shown in expressions (3) and (4), Yamato determines a deadline time using time t prescribed by the system or a transfer rate S_j registered in the transfer rate table 72, while the scheduling unit of the present invention determines deadlines (deadline times), based on the transfer rate (the number of valid packets + the number of dummy packets) of received data.

With respect to claim 2, the Examiner has also allegedthat Yamato discloses the scheduling unit of claim 2 of the present invention.

The transfer control device 70 of Yamato comprises a transmission buffer 74 temporarily storing data read from the storage device 10 and a rate variable data transfer unit 75 transferring data to be transferred, stored in the transmission buffer 74, to the client 60 at a transfer rate corresponding to the file at a designated time (col. 16, lines 26-31). The request management unit 71 of Yamato stores various information in internal memory while reading successive read requests received from the client 60. Information to be stored includes at least a name for identifying a transfer object file designated by a successive read request, the identifier of a block whose read request is issued last and the deadline time of the lastly-issued read request. The unit 71 further stores various information, such as the amount of data whose read request is yet to be issued, the amount of data yet to be transferred to a client and the occupied area of the transmission buffer 74 (col. 16, lines 38-48).

The differences between Yamato and claim 2 of the present invention are as discussed below.

The file-basis transmission time computing unit 73 of Yamato computes the deadline time of read data using the expressions (3) and (4). Yamato computes the deadline times T_{start} of the first block data by adding time t prescribed for the system to time $T_{current}$ when a read request is received (expression (3)), and the deadline times T_N of the second and subsequent blocks by adding a value obtained by dividing the data size L of the preceding block by the transfer rate S_j of a file in question registered in the transfer rate table 72, to the deadline time T_{N-1} of the lastly issued read request (expression (4)).

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However, when writing data to be written, the present invention of claim 2 records deadline information in a disk 66 (storage medium) as one field of a format, as shown in Fig. 15. When reading data from the storage medium, the present invention of the data to be written according to this deadline information determines a reading deadline. Thus, when writing data to be written, the present invention determines the reading deadline of the data to be written according to deadline information to be written in a storage medium. However, Yamato computes it using the transfer rate S_j of the file stored in the transfer rate table 72. Thus, Yamato differs from the present invention of claim 2 in the determination method of the deadline of data to be written.

It is submitted that the present claimed invention of claims 1, 2, 8 and 10 patentably distinguishes over Yamato and withdrawal of the rejection is requested.

On page 5 of the Office Action the Examiner rejected claims 6, 7, 9 and 11 under 35 U.S.C. § 102 as anticipated by Kamel.

The invention of Kamel relates to a new algorithm that supports a simultaneous read/write request issued in real time by a user, and provides a new disk scheduling algorithm that supports R_{dl} and R_{nn} categories for a read request and a W_{nn} category for a write request.

R_{dl} category: Read requests each of which has a deadline, and which may be lost when congested.

R_{nn} category: Read requests each of which has no deadline, and which may not be lost even when congested within the system.

W_{nn} category: Write requests each of which has no deadline and which may not be lost even when congested within the system.

The Examiner has alleged that the element 12 (MSFS)) shown in Fig. 1 of Kamel corresponds to the determination unit of claim 6 of the present invention (hereinafter called "the present invention"), that the element 28 (memory buffer pool) shown in Fig. 2 of Kamel corresponds to the write area of the present invention and that the element 32 shown in Fig. 2 of Kamel corresponds to a plurality of positions for writing data of the present invention.

Figs. 5A or 5B of Kamel disclose that all write requests are closely located. If it is assumed that a write request W_n is inserted in a disk queue 32 at a position n (D[n]), the number of write requests located in positions 0 through n-1 of the disk queue 32 is denoted as NumWrites (n-1). The NumWrites (n-1) represents the number of write requests ahead of W_n in the disk queue 32 and they are most appropriately processed by the scheduling algorithm prior

to processing W_n (col. 10, lines 33-39). A buffer space where a page can be freely written into a disk 30 (space occupied by the write page) is generated. Therefore, a specific page is written into the disk 30, the deadlines of all the pages in the writer buffer pool 28 are relaxed as well as the deadline of the write page in the disk queue 32 (col. 9, lines 41-45).

A specific page is forced to be written into the disk 30 by one write request process. For this reason, several buffer spaces are made free in the write buffer pool 28. As a result, a specific write request is processed by a disk scheduling process (col. 10, lines 43-45).

The Examiner has also alleged that the element 114 shown in Fig. 5B of Kamel corresponds to the control unit of the present invention.

In Kamel, when a write page request arrives, the corresponding page is placed in the write buffer pool 28 (col. 7, line 41 and 42). The flowchart shown in Fig. 3 shows the insertion of a W_{nn} write request in the disk queue 32. Once the write request for a page P_W arrives at the write buffer pool 28 (S40), a media segment file server 12 assigns a deadline to the write request (S42). Then, the write request is to be inserted into the disk queue 32 (col. 8, lines 7-13).

In contrast, a write area determined by the determination unit of the present invention, as described in claims 6, 9 and 11, is a disk type storage medium. However, a write area determined by the element 12 (media segment file server 12) of Kamel is an area of a main memory buffer pool 28 where a page to be written into a disk is stored in advance (col. 5, lines 24 and 25). The memory buffer pool 28 is not an area of the disk 30 and is a memory area possessed by the media segment file server 12. Thus, the element 12 (media segment file server 12) of Kamel differs from the determination unit of the present invention in the storage medium of a write area to be determined.

Kamel also targets the access schedule of a system for editing data to be read or have been read through a memory buffer module and newly writing the edited data into data already stored in a video server (storage medium). Therefore, in the case of Kamel, there is a deadline in only a read request and no deadline in a write request (there is no need for a deadline in a write request). However, since the present invention must also write data in a new storage medium in real time, a deadline must be set even for a write request. Thus, Kamel differs from the present invention in a system itself, which is the target of a schedule algorithm. In other words, they differ in an object.

With respect to claim 7, the Examiner has alleged that the element 20 (memory buffer pool) shown in Fig. 2 of Kamel corresponds to the write area of the determination unit of the present invention.

Kamel uses the following three parameters in the determination process of a deadline:

N_b: the size, in bytes, of the write buffer pool. 28

P_w: the size, in bytes, of a write page

(The number N_w of write pages that a buffer can accommodate can be computed from these two parameters of N_b and P1.)

λ_w: the arrival rate of disk write requests to the system

Assume that at time t, a user requests that page P_w be written into the disk 30. A deadline is assigned for page P1 so that page P_w has to be written into the disk 30 before the deadline.

The deadline of thus write request is computed in the following way. Let n_w (t) be the number of write requests that exist in the buffer pool 28 at time t, and n_f (t) be the number of free buffer slots in the buffer pool 28 at time t. Then, n_f (t) = N_{w-nw}(t). In the worst case scenario, because of the R_{dt} read requests, no pages will be written from the buffer 28 to the disk 30, and at the same time, new write requests will continue to arrive at the write buffer pool 28 at the rate of λ_w. As a result, at the time a write page p_w arrives at the buffer pool 28 (due to a new write request), time needed d (t) before the write buffer pool 28 gets full, can be estimated given this worst case scenario. d(t) can be computed as follows:

$$d (t) = t \quad | \quad n_f (t) /\lambda_w$$

In fact, d (t) is the deadline of any page in the n_f (t) write buffer pool 28 at time t, i.e. d (t) is a global deadline for all the pages currently in the write buffer pool 20. As a results when page p_w is written physically into the disk 30, it frees one buffer slot in the buffer pool 28 (col. 6, line 55 - col. 7, line 18).

The write area of Kamel is the (memory) area of the memory buffer pool 28 and is not that of a disk type storage medium as recited in claim 7.

Kamal computes a deadline d (t) at time t from both the number n_f (t) of free buffer slots in the buffer pool 28 at time t and the ratio λ_w of write requests that arrive at the write buffer pool 28 (col. 6, line 55 - col. 7, line 17).

The deadline unit of the present invention of claim 7 determines the write area of a disk type storage medium, based on at least one of the number of write requests and the sum of

transfer rates of a plurality of write requests. Thus, the deadline unit of the present invention determines the write area of a disk type storage medium. However, the element 12 of Kamel determines the deadline d(t) of a write request. The present invention and Kamal differ in a determination target.

It is submitted that the present claimed invention of claims 6, 7, 9 and 11 patentably distinguishes over Kamel and withdrawal of the rejection is requested.

It is submitted that claims 3-5 continue to be allowable. It is further submitted that the claims are not taught, disclosed or suggested by the prior art. The claims are therefore in a condition suitable for allowance. An early Notice of Allowance is requested.

If any further fees, other than and except for the issue fee, are necessary with respect to this paper, the U.S.P.T.O. is requested to obtain the same from deposit account number 19-3935.

Respectfully submitted,

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